Social Services Computing Environment and Associated Issues

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Department of Social Services and Solidarity Timor Leste (Dili)

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0.1 Abstract

This document describes the status of the Computing Infrastructure as found at the Department of Social Services and Solidarity in Dili, Timor Leste in August 2003.

Sections include recommended processes and procedures that may be implemented or improved. Emphasis is given to the system as a holistic entity and how it may be made to better serve the needs of the department. The approach is general, and to a large degree portable.

Addenda outline some specific technical procedures that may be used for maintenance or assist in trouble shooting. An index is included in the PDF version of this document.

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0.2 Preface

computerbank

This Report attempts to quickly overview the current Computing and Information Technology Environment as found at the Department of Social Services in Dili, Timor Leste August 2003.

The reader shall find little that is definitive, authoritative or absolute. Time spent gathering the information was limited to three weeks on site and consisted of observations gathered undertaking general IT work and maintenance.

Here Hardware and Software are treated as fungible, the tools that they are. My opinion is that the focused, ongoing, development of Skills, Training and other Human Resource Capacities would be of greatest benefit to this department. By extension those benefits may flow to the general community of Timor Leste as this key department increases capacities to effectively deliver positive outcomes and communication across government generally.

Areas covered include current capacities,utilisation, maintenance issues , future approaches and options.

Other subjects and potential issues such as training , security, redundancy , procurement and initialisation are covered in brief form. Addenda outline some suggestions and technical procedures that may be followed.

Primarily this report addresses some current “bushfires”. It is written with a great appreciation and respect for those engaged in the task of building the social fabric of Timor Leste. Volumes of good work have been and continue to be done. Apparent to even this short term visitor is the applied talent, intelligence, and enthusiasm for what must at times seem like an impossible task. The people of the Department of Social Services and Solidarity, and it's International Advisers are a credit to the aspirations and ideals of the worlds newest nation.

Raw human ability and a functional quantity of basic infrastructure are available. The skills, processes and mindsets for efficaciously using available Information Technology resources are not.

0.3 History

Version 0.0.4 19th September 2003 Peter Gossner gossner@arcom.com.au

This version fixes spelling and layout errors. Some layout changes have been made to ease autoconversion to html. Some small changes to content: re anitvirus and defragging.

Chapter 1

Status Quo

1.1 Hardware

1.1.1 Computers :

Broadly speaking the number and quality of the current and incoming machines seem to be appropriate. The median machine has an i686 (Pentium$^{\mathrm{TM}}$) class Processor running at 500 Megahertz with 128 megabytes of Fast RAM. Most machines have a single Hard Disc Drive [HDD] of approximately 10 Gigabytes capacity, contemporary bus protocols, and speeds.

The recent acquisition of well made Compaq$^{\mathrm{TM}}$ and IBM$^{\mathrm{TM}}$ computers has done much to enhance the productive capacity of the department as a whole and has gone some way to ensuring a minimum level of hardware redundancy. Although more needs to be done in this and other areas, it should be noted that the quality of recent hardware is that of enterprise level and is an appropriate fit to the needs of the Department. At least as I was able to perceive them.

1.1.2 Peripherals

Printing

By far the most common external peripheral is the black and white Laser Printer. Generally divisions have a single unit or have shared access to a printer as required. Much of the long term filing appears to be paper based (probably wisely at this stage) and these printers are central to that . A networked system would enable shared utilisation of these machines, and help lower unit printing costs appreciably.

Colour printing facilities are limited, and more may be effectively deployed. The multilingual nature of the Timor Leste community, and the often low levels of general education indicate the need to further develop clear accessible methods of communication. The capacity to design and develop graphics based documents is central to that end.

I observed no deployment or training in graphics or desktop publishing tools.

Others

There seems to be little else in the way of external peripherals. USB based digital cameras are used and I am sure the occasional Laptop is bravely plugged into a parallel port or two. I cannot recollect seeing scanners, high density disc drives or any of the tools that have become the norm in offices. Perhaps the most valuable *onboard* "peripheral" is the CD Burner. Rewritable discs are used to good effect, with images rather than file transfers or storage. Once again a lack of training or consistent standards leads to a frustrating number of failures.

Effectively no maintenance of software or hardware for peripherals exists.

1.1.3 Deployment:

As far as I was able to observe all Social Services personnel have shared access to at least one desktop machine and black and white laser printer. A lack of networking facilities and training prohibits productive, and secure utilisation of these resources. The major inhibiting limitations are an Administered Network , training in simple maintenance procedures, and Information / Office Technologies generally. Users seem self taught, limited to utilising a basic subset of the tools they have available to them. *Which is not to say they don't share, maximise and leverage existing skill sets.*

1.1.4 Maintenance and Upkeep

Staff are generally unaware of the need to keep the machines and associated equipment clean and as dust free as practicable. There is little knowledge and little effective Technical support in this area.

Generally machines are run until failure, at which point action is taken, often with little success. No concerted attempts are made to remediate underlying causes of problems, or plan for future occurrences. In many instances running disk clean up tools is all that is required to "repair" the "broken" computer. Unfortunately virus infections or corrupted systems files often prevent successful outcomes by these utilities. (The repair attempt being made reactively, after the corrupted files system has become irretrievable for these tools)

Uninterruptible Power Supplies are available but often set up incorrectly. Again there is little technical support in this area. A perhaps unavoidable lack of standard power outlets complicates deploying these important units.

This coupled with a total lack of electronic backup of [1]Hard Disc Drive content is worrying. Key machines and files are as secure as the Hard Disc Drives they contain, a power surge could effectively destroy many man-years of work. The delivered quality of the Dili Power Supply and the remedial nature of much of the electrical infrastructure further complicates this area.

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[1] Hard disc drive. Fixed drive usually on an IDE or SCSI bus.

1.1.5 Other Harware Resources

To the best of my knowledge some 300 donated low end Pentium boxes are being held off site, in storage by the Department. These computers were unable to be deployed due to a lack of technical assistance at roll-out. I have not examined these machines and cannot judge their integrity or value. It may well be that they will find great utility as “[2]thin clients” on a Unix powered network. They would be underpowered if tasked with running the current resource hungry Operating Systems and Office Suites, as stand alone machines.

1.2 Software

1.2.1 Operating Systems

All Social Services machines are running some variation of the Microsoft Windows Operating System [OS]. Whilst I was on site I made some efforts to match OS resource requirements to the machines and while no doubt more could be done in this regard, all machines are capable of running at least Windows 98SE. Most are able to run Windows XP at a useful speed.

The various versions and the general approach to Hardware / Peripheral interfaces taken by Windows, causes some complications in regard to various drivers for Printers and other “Plug and Play” devices. Effective solutions to these issues are almost universally beyond the training level of the Office staff.

1.2.2 Applications

Generally speaking The Microsoft Office$^{\text{TM}}$ Suite covers all the required data entry applications. i.e.Word, Excel and Access.

There seems to be some diversity with other peripherals and applications (for example CDROM Burning Software) and this leads to instances of format incompatibilities.

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[2] a computer that gathers most of its resources from another computer. (usually a powerful server)

There is no deployment of a professional shared database nor the networking and file sharing capacity to fully utilise such.

Desk Top Publishing tools no doubt could be effectively and creatively utilised should they be made available.

The widespread use of the Microsoft Office Suite (and the Operating System itself) requires the use of late model powerful machines. Should Social Services become locked into these applications they will also be locking themselves into an ongoing expensive hardware upgrade regime; driven by software release cycles rather than the true service life of the hardware. New faster machines will have to be purchased for very little added benefit.

1.2.3 Install Integrity

Whilst on-site I made some small progress toward some basic security of binary distributions for Operating Systems and Applications. Checked copies of current and install disks are now being held on site and should be used as the sole source of installed software. Newer versions should be test installed, virus checked and marked as validated copies before being used. This is a short to mid term solution only.

There is no access to source code or high end configuration tools. Therefore “out of the box” solutions are being applied to sometimes unique situations. No enterprise level development, improvement or refinement path can be built in such a situation. The use on non-registered (unlicensed software) makes it impossible to guarantee the integrity and long term stability of the entire asset.

All software should be tested before being put to general use. A repository of “Validated” disks should be implemented as soon as possible.

Longer term, greater control will have to be placed on what and who installs software, this should be implemented as a system of quality control rather than as a restriction on Operating Systems or Applications. Networks may be set up so as to concurrently run all modern Operating Systems. (even Windows).

Security generally is almost non existent.

1.2.4 Maintenance

This area is perhaps the most alarming. No standard or otherwise deployment of antivirus and Windows maintenance tools has been implemented. Machines should be defragmented at least weekly and it is quite possible on all versions of Windows to fully automate this task.

Backup procedures are nonexistent. There seems to be no “culture” for this and no recognition or understanding of the need for it.

At the moment all of the data contained on every machine in Social Services is vulnerable to virus attack, power supply surges, lightening strike or even civil disobedience. As machines are not networked and contain no high capacity removable storage media there is no effective way of backing up large amounts of data outside a single machine.

Finally (and again) the near universal use of unlicensed software precludes the use of up to date anti virus and firewall tools. It would be prohibitively expensive to keep these tools up to date with the current software infrastructure.

Every machine I examined on site had at least one virus and often had very many.

File sharing (via [3]sneakernet) propagates the virus effectively across all machines.

The implementation of a network without high end security tools will greatly exacerbate this problem.

1.3 Observations

With the notable exception of Portable (Laptop and Handheld) Computers, the equipment both core and peripheral exists to operate the Department at it’s current level of activity and staff. There is little redundancy for equipment, or personnel and no active system for IT skills development or deployment.

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[3] sharing and swapping floppy disks

A useful target could be a desktop machine on every desk and to the best that I could observe it would seem that at least 80% of staff have reasonable (shared) access to a machine. Each section could have at least one person who would undertake to improve the current usage of the Computing Tools available, and to promulgate improved standards of basic usage. (This need not require high levels of specialist training)

As more staff come into the Service and off site work is undertaken, more Laptops will be required both for field work and as Desktop replacement machines. The facilities do not exist to efficiently integrate data from and to these machines, on-site or from the field.

All of the existing hardware is at risk from virus and similar activity and is in any case underutilised from the point of view of user account access , file sharing, and communication.

Essentially each machine is a standalone unit with no networked capacity beyond limited floppy disk / CDROM transfers. No machine in the department could be considered virus clean or secure.

The total lack of hardware and software maintenance is resulting in unnecessary frustrations while using the equipment and degrading the service life of each unit particularly.

While efforts have been made to secure the power supply for the building as a whole and each machine where possible, the current deployment of the [4]UPS units does little to provide a professional, cost effective guarantee of power supply. The battery life of each unit is degraded quickly as units are regularly discharged beyond their design parameters.

With current usage patterns the replacement cycle for all equipment could well be as short as two years (accidents aside) and no critical files should be on machines with Hard Disc Drives older than that in the current situation.

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[4] Uninterruptible Power Supply

1.3.1 Summary

The Total Computing Resource although being used to the best that current training levels and infrastructure allow is underutilised.

Given the finite nature of budgets and donations I suggest that measures be taken to remediate, the IT skills base and infrastructure in a controlled and integrated fashion. Targets include: basic maintenance, application familiarisation, security and "whole of system integrity" awareness. Where staff have experience in these areas efforts should be made to encourage the sharing of knowledge.

Activities should be undertaken to maximise the useful working life of the equipment, its usefulness within the department proper, outer offices and field workers. Currently no productive Interdepartmental electronic system seems to be in place, this also is an area that surely could facilitate the effective, timely and productive use of department resources.

From a Hardware and Physical Resource point of view the deployment of a professional (and preferably Unix style, Open Source) Network should be examined.

The benefits from such an approach include, the ability to use slower older machines for longer, efficient use of peripheral devices, vastly improved file and application sharing, simplified application upgrades, access to a complete tool kit of network services, higher levels of security, fully searchable caching of Internet content, excellent training and skills development opportunities. Of course an Open Source solution to this issue bring even greater benefits. Not least of which is the possibility of ongoing, off-site, low cost support.

Efforts should be undertaken to draw on the skills developed by other Timor Leste departments, the UN NGO's and other agencies in active service in Dili and beyond. Funding should be sort to develop and implement an ongoing training scheme which integrates at a fundamental level into the Departments recruitment , tasking and skilling processes. The potential for such an approach to be leveraged beyond the department should be investigated.

Chapter 2

Immediate Steps

This chapter outlines some actions that may be taken on site with current resources (and this document).

2.1 Hardware

2.1.1 The care and feeding ...

The dust you see accumulate on surfaces overnight also accumulates in the equipment.

Desktop computers are designed to operate optimally in an airconditioned clean office. Not the busy, crowded, hot humid and often nearly public spaces that Social Services currently has to contend with. (The concerted efforts of the cleaning staff aside)

Dust not only causes noisy fans and even clogged heat sinks but can actually cause corrosion and poor electrical connections within the computer case itself. (it holds moisture from the atmosphere against Printed Circuit boards and other potentially sensitive components.) High temperatures and humidity only exacerbate these problems.

Beyond stripping the machines down every six months there are some sensible steps that may be a taken regularly to keep the computers in good working order.

A concerted and maintained effort needs to be undertaken to build a sense of pride and value in the equipment being used. These are expensive and useful machines. The hardware contains data that should be considered invaluable perhaps irreplaceable. After all it is the result of lots of hard work.

To facilitate this, basic cleaning materials could be left in some convenient, visible and accessible place in each building. These need be no more complex than a mild general purpose surface cleaner (or even a dilute disinfectant) a pack of washable soft non paper wipes (e.g. Chux) and a [1]*soft natural bristle brush* say 25 mm across. [2]White board cleaner or Benzine are NOT suitable.

Mice, Keyboards and Monitor Screens should be able to be cleaned as required and perhaps scheduled weekly. All Printer rollers should be kept polished to a bright chrome finish and the entire paper path cleaned at least with each ink change. A soft brush (used regularly) makes this a safe and simple job.

Printers and Keyboards should be covered when not in use and Monitors covered overnight.

Desktop Keyboards may also be inverted and gently tapped against the desktop surface to dump detritus from between the keys. They may also be brushed out and wiped clean when the computer is off.

The desk spaces around the workstations should be wiped clean every night. Paperwork needs to be organised so as to facilitate this.

Mouse pads should be cleaned weekly or as required. They are often the cause of “sticky or clunky” mice. Mice are designed to be disassembled for cleaning. The roller ball and internal rollers should be kept quite clean for efficient use. A cotton bud makes this fiddly task relatively easy.

Folders, paperwork covers etc. should not be left on top of the CPU boxes , the monitors or any other piece of electronic equipment. This can be a fire hazard, reduces the ability of the equipment to maintain a reasonable working temperature, and makes if very difficult to keep the units clean.

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[1] A natural bristle paint brush is suitable and cheap.

[2] White Board Cleaner may be used with some care on the monitor screens.

All external vents/fans on CPU boxes and Monitors should be dusted out regularly, this is probably best scheduled weekly. The outer cases of the same should also be cleaned of dirt, dust and paper clips (and such) at the same time. This sort of build up happens slowly and usually imperceptibly to the regular user so may best be done by the (trained) cleaning staff.

Extreme care must be taken with solvents and abrasive cleaning agents especially around and on laptop screens, they are easily damaged by abrasion and many chemicals. Please try to access the user manuals for the machine in question.

A mild detergent is usually sufficient for all else but the [3]CRT monitor screens where a propriety glass cleaner may be used (or methanol and a brisk polish). If surface cleaner is used it MUST be totally polished off the monitor screen. It will quickly build up to a greasy finish.

Please test all new cleaners and wipes on a small section of whatever is being cleaned before general application !

The only real consumable on most PC's (apart from the occasional failure) is the CMOS battery.

These are generally easy enough to change and you will generally get a "low battery warning" at boot up for some little time before they need changing. It is best to replace them at this point. Most machines should present little problem in this regard.

Please note: Changing the CMOS (BIOS) battery often means at least resetting the clock and some of the low level settings from the BIOS configuration screens. *Almost* all machines will function fine with *default or optimum* settings.

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[3] Cathode Ray Tube. The desk Top monitors

2.2 Software

2.2.1 The Windows Operating System

All Computers running any version of the Microsoft Windows Operating System should be configured to automatically run disk cleanup repair and de-fragmenting tools at LEAST weekly.

The "Task Scheduler" is usually the most convenient interface to these system tools and lunch time is probably a good time to have it done. (the machines are generally still on). Once a week or so the clock should also be checked and reset to the correct local date and time ... very few are.

Generally this is done by double or right clicking the clock readout in the bottom Windows task bar.

[4]*Please note:* ANTIVIRUS SOFTWARE *may prevent the automated running of disk "clean up" tools. You will have to disable them manually or via some automated means at the correct times.*

2.2.2 AntiVirus Software

There are disks available (two copies) which contain at least two very good anti virus suites.

These are MacAffee Professional$^{\mathrm{TM}}$ and Norton Anti Virus$^{\mathrm{TM}}$. It is probably a good idea to mix them up across the departments machines. Any single machine may only run one of these tools at a time.

Somebody should check for new versions perhaps on a monthly basis from the local [5]supplier.

It is very important that these utilities are kept as up to date as possible and are configured to automatically check any removable [6]media when accessed. (e.g. Floppy disks CD's)

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[4] added release 0.0.4.

[5] Mr Brams (Roughly Opposite Victory Hardware in Colmera)

2.2.3 Applications

As most machines are capable of running Microsoft OfficeXP I would suggest installing it on any machine with 128 Megabytes of RAM or more. This will at least provide a consistent interface to the most common applications and reduce the number of formatting errors between versions of Microsoft Office. In the mid term the installation of Open Office or Suns Star Office should be investigated and trialled. Abiword should be trialled as a light weight (very functional) Word Processing tool. All of these applications offer professional level tools that are Open Source (legal) , [7]Cross Platform, less resource hungry, and also have better multi-language support. Copies of Open Office have been included with the install disks. It should also be noted that efforts have recently commenced to translate the interfaces of Abiword and Open Office into Tetum.

The installation of more than two (non Windows / Microsoft) games on any machine should be discouraged. Games are a common source of damage to Windows Registry files, the only sure cure is to remove the games and reinstall Windows and then the entire suite of applications required. This includes all driver files for printers scanners and CDROM burning software. *This can take many hours and there is always a danger of losing data.*

I firmly believe that games have a useful place in building confidence , skills and familiarity with the [8]PC generally, they are also good [9]R&R. All things in moderation however.

As a general rule a Microsoft machine will do one thing at a time very well, two things somewhat less well and beyond three will usually cause you problems. The games that come with the Operating System are not a problem.

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[6] floppy disks ,CD/DVD disks, zip drives, temporary network connects (e.g. Laptops) should all be considered potential threats to your system integrity. Even brand new (sealed) name brand disks have been found to hold virus and other "infections".

[7] Work on all common Operating Systems with nearly identical interfaces

[8] Personal Computer

[9] Rest and Recreation

2.3 Value, Procurement and Roll Out

This section outlines Procedures and Protocols that may be considered when rolling out new equipment in the immediate future. The primary objectives are to register the machine as an asset, inspect the incoming hardware for serviceability and potential uses, remove past users data, and install and configure so as to minimise potential security, usability, and reliability problems.

2.3.1 Overview and Value

To maximising the productive and effective life and value of any flexible asset, is to make sure it enters the system with an understanding of it's value, condition, potential service life and maintenance requirements. Even the humble desktop computer, reliable as it is, requires scheduled, proactive maintenance. The more so as it is the receptacle of many hundreds of man-hours of work. Once your Hard Disc Drive has failed it is very difficult and expensive to recover the valuable data it contains. Preventing loss of data , or constant running problems, starts before the machine arrives on site.

Purchasing and Procurement is currently totally reliant on the valuable scrounging and political skills of local and Aid support staff. Hopefully local staff are mastering these skills and capacities to identify and research the price [10]"sweet spot" when machines are purchased.

At the moment Social Services has less than optimal Procurement procedures as the vast majority of equipment is donated. Therefore there is little or no site support, warranty, or service contracts.

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[10] The best price / value point. The latest and fastest rarely represents good value in IT Technologies. Broadly the best value is often configurations and technologies some 12 to 18 months old.

I understand some small numbers of machines have also been purchased. In any case there is little that is wrong with the quality and suitability of the units arriving at the department recently (and hopefully this will continue). The newer Compaq and IBM machines are a good fit to the organisations needs. Any steps undertaken to monitor potential problems and maintain Software and Hardware in good order represent a good return for the costs involved. The low initial cost should not exclude some contemplation of the replacement value of an equivalent or better infrastructure.

In short these machines are very valuable assets because:

1. They will cost real United States Dollars to replace.
2. Potentially many hours of time can be wasted fixing broken software / hardware or recovering work that has been poorly handled.
3. They hold in the file structures potentially hundred of hours of valuable, creative work. (and creative ideas and work are not fungible)
4. Man-hours will be devoted to maintaining them.
5. Retraining costs for new machines may well be significant.
6. They have the (mostly unrealised) potential to vastly increase the level of intra and inter departmental communication and skill sets of all of those who use them. Once connected to the Internet and or a network will have the potential to deliver fast cost effective and timely research and communications tools to the organisation.
7. Potentially have some recoverable dollar value at the end of their service life.
8. Finally I would like to offer the observation that the true value of a computer is not a simple coefficient of purchase price, Hard Disk space , [11]RAM capacity, [12]CPU speed and cost of software. Rather it's true Value rests in the ability to deliver reliably and simply, data storage, manipulation and most importantly

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[11] Random Access Memory. Sometimes called extended memory

[12] Central Processing Unit

communication, with other people. For this reason at least *what you enable your computer with* is much more important that how fast it is. The more you enable it and the operator the more valuable and efficacious it becomes.

2.3.2 Roll Out

When any machine arrives for the use of the department I suggest the following procedures be followed.

1. The Unit and all peripherals are secured in temporary, accessible storage. No machine should be used until it is cleaned, of old files and potential virus problems.
2. Inventory Numbers are assigned to each physical assembly and that assembly be permanently marked with that Identification. (there is an effective system in place). The Inventory database needs to include the source of the equipment.
3. The equipment should inspected, cleaned, assembled and powered up. Use this chance to dust out the internal components of the machine and replace the CMOS battery. (if Practicable) Any repairs, hardware upgrades or additions should be performed now. The CMOS (BIOS) Clock should be accurately set now !
4. All hard discs should be *formatted* (wiped clean) removing existing files, operating systems and hopefully virus and other "antisocial" problems. There are much more sophisticated ways of doing this but FDISK should be enough for the short term. Most of the Proprietary computers by companies such as IBM and Compaq also include tools to do this. Do NOT use these tools to restore the Operating System. Install new.
5. Install the Operating System that best fits the deployed units requirements and capacities.Install From validated (tested) recent sources.
6. A log of all of this and the following should be kept both on the machine in question and a copy made and transfered to some safe place. All the following

steps should be added to that log, now and in the future. Note any hardware problems, driver issues within the log. (example below)

7. For Windows systems Install anti Virus and Firewall tools now. (before any applications are installed) Follow on to install the applications required when deployed.
8. For all systems ensure the following user accounts are in place: administrator guest visitor and at least an account for the main user of the machine.(see "accounts" below for details). Even for Windows98.
9. Run all maintenance tools as least once setting up any automatic tools to run regularly at a time when the machine is likely to be powered up and not an inconvenience to the end users. (playing games at lunch time does NOT count)
10. If possible run the machine continuously for 24 hours giving it something to do (screensavers are appropriate) . The idea is to run the processor and any on board peripherals. Technicians call this a "burn in".
11. Check all applications and peripherals work as expected as a guest user and as the main user .
12. Deploy. Setup the machine in situ and pass on password for the main users of the machine. Test printers and other peripherals in situ. this includes CDROM players floppy disk drives etc. Explain that admin level accounts are for installation and maintenance ONLY. Guest and Visitor accounts are for casual users or indeed Visitors. (Helps keep the file system tidy, and offers some basic security). Now would be an appropriate time to add user level accounts if not already done.

Which Windows ?

I suggest the following simple check list:

1. Machine has less than 128Megabytes of RAM ? Install Windows98SE

2. Machine has less than a 500 Megahertz processor ? Install Windows98SE
3. Machine has more than 128 Megabytes or RAM AND at least a 500 Megahertz Processor (any type) Install WindowsXP Professional.

Notes:

Do not install Windows-ME (you gain nothing at all for a slower machine)

Do not install the “Home” versions of XP or 2000/3.

Windows2000 Professional or later versions could also be considered on 128Megabyte RAM plus machines.

All machines installed as above will be able to run Microsoft OfficeXP.

Accounts

There are many good reasons for running well configured user accounts. Not least of which are Networking, Group work, Security and Customisation.

I suggest the following accounts and permissions be configured as a minimum.

Administrator	This should be the only full permissions account on any Windows Powered machine. Password: admin@social (e.g. only). Eventually a more secure password scheme should be implemented.
Guest	A general user account for casual everyday users. Permissions should be restricted to running applications only. On WindowsXP this account requires NO PASSWORD
Visitor	Same permissions as Guest. This account is intended for people who will only be temporarily using the machine for a short period of time. The files they generate may not be of use to general users and indeed they may require no access to the shared files on any other machine. Password: visitor@social

Main Users (e.g. Rosalie) One of almost any number of user accounts. This account on WindowsXP should have “power user” permissions. Password: Rosalie082003 . [namemonthyear].

Please point out that users can set their own passwords, desktop themes, mouse settings etc. Also make sure they are aware that

a/ on Windows it is very easy to get around a password and

b/ that the Administrator always can.

Logging

While certainly not absolutely critical. It will be of great benefit if a log of a machines configuration, hardware and software updates are kept both on the machine in some standard place and off the machine in some secure place. Perhaps the trick here is to keep it as simple as possible.

The log file should be in plain text (not word or any other format) and should be writable by the administrator only. The simpler it is the better.

Contents might include:

Supplier, Inventory Number (for all deployed parts) Deployed Date, Network Name (if applicable), Basic Specifications, Install History, Hardware and general notes.

There are many ways to approach this. The current trend is to use XML formats. Here is a simple text file approach.

Each “data field” starts with a # mark. two or more ## starts a new section.

DO NOT use word or any other word processor to write this file.

Notepad or a text editor is all you need.

Simple Text Log.

```
############################################################################
```

```
#Local System Log File
#C:\LocalLog.txt
#Inventory Number: TL-SSS004(b)
#Supplier: International Labour Organisation
#Supplier Delivery Date: 08302003
#Service Contact: Mr Fixity
234 Rua DA Caicoli
Dili
Timor Leste.
#Phone: 720123455678
#Contract Ref: TLSSSservicecontract2004IT
##Hardware Specifications ###################################################
#Chassis Serial Number: CPA20023456789
#CPU: Pentium 3 700MHz
#RAM: 512 Megabytes
#Hard Disc Drives(s): ADC 20gig 7200rpm 4meg cache #Serial Number: 200312345678q
#Model Number: WAC20UDMA724204
#Monitor: Compaq 17 inch #Model Number:CPU17mega #SerialNumber: COM2002345678m
(and so on for printers CDROM players etc.)
## Inspection Notes #####################################################
#date: 27082003
Power Supply fan a little noisy.
Missing printer Cable
CDROM Player slow to start up.
```

```
## History ####################################################################

#date: 30082003

#Installed: Win-XP #regNo. typo23fa-arty6etcetcblah

#Machine Name: Zeelia2

#Network Address: 172.16.10.105

#Account: Administrator #Password: admin@social

#Account: Visitor #Password: visitor@zeelia

#Installed: MacAfee Virus Pro 700 #regNo: 12349876coffee

#Installed: Microsoft OfficeXP #regNo. SOME_ISLLYNUMBERR4U

#Created: User Accounts. Zeelia Amandio Mateus Roxanna (all power users)
```

(and so on)

How much information you need here is driven by requirements like Insurance, Service Contracts, Stock Tracking Procedures, Security Policy and so on. Generally the LESS the better. Perhaps you do not even need a log file. :) Keep It as Simple as you can. For future proof data storage consider using only simple [13]ASCII text files or validated [14]XML.

It's important to note software registration numbers, critical passwords, and the Operating System install history somewhere, off the machine. This may be paper based. (print out the log file.) On a fully networked system the Systems Administrator would keep all of this safe and secure in a locked down, backed up, encrypted admin file somewhere.

---

[13] American Standard Code of Information Interchange

[14] eXtensible Markup Language. A powerful and growing approach to organising raw data in a way that allows you to present in in almost any format.

Chapter 3

The Future

This section proposes some mid to long term ideas that may be considered for adoption.

The Objectives are:

Increase all Computing Related Capacities: Human, Software and Hardware.

To maximise the productive use of the existing Computing Infrastructure while keeping the Total Cost of Ownership at realistic sustainable levels.

Ensure the Security and Integrity of all files produced by the Department

Enable new approaches, protocols and technologies.

Develop and grow portable, general and specialist Information Technology skills.

Deploy those skills within the current and expanded Social Services Infrastructure.

Build an exportable ongoing culture of self help, research and IT policy development.

3.1 A Network

The single most effective action that could be taken to enable more effective use of the current infrastructure would be the establishment of a solid Ethernet based network. I understand that a Windows 2003 Server based network is currently being installed and commend this as a reasonable short term solution. In the longer term (say more or less a year out) a professional flexible Network should be built and configured using existing Ethernet infrastructure.

3.1.1 Services

Any network should be able to deliver the following direct services and should be capable of leveraging any skills currently in situ or developed over time within the department.

Secure interface to the Internet

Local and external Email services. Group-ware and Standard.

Caching of Internet content

Messaging

File transfer and storage

Secure Backups

Centralised and distributed database services.

Application Server

3.1.2 More Services

Other applicable tools and approaches enabled by a Network would include:

Thin Client Workstations

Clustering of CPU and RAM Hardware Resources

HTTP server (web sites)

FTP server

Dictionary and other writing tools (multi languages)

Transparent Group based file access

Multi Operating System support.

3.1.3 Recommendation

This document is not the place to develop arguments for Open Source Software or against Propriety Software.

I make the following recommendation with this observation:

Owning your own tools and intellectual input can only leverage your greatest real asset; knowledge and the ability to put it to productive work.

For reasons of cost, security, ownership, flexibility and quality I would recommend a Linux or FreeBSD based server and gradual migration to Linux based networked workstations, (thin clients and “standalone”). The design and implementation of this infrastructure can be initially undertaken off-site and improved and customised by Departmental Staff as training takes place.

The flexible, and extensible nature of Linux in particular, offers great opportunities for true capacity building and ownership of Computing Resources. If you own your tools you can do what you like with them. The ability to share code, and knowledge without restriction empowers end users and administrator level staff with portable skill sets.

The roll out of this system should be undertaken with as much local input and training as is feasible, further more Social Services should investigate accessing and developing the required skills both “in-house” and beyond in perhaps a cooperative whole of government approach.

Chapter 4

Addenda

4.1 HOWTO’s

The information in these “How To” sections will require a level of Technical Experience to implement.

(or perhaps even understand).

These are not intended to replace proper and complete training , rather they are an attempt to empower the more interested and proactive person to undertake some work that needs to be undertaken on-site and reasonably quickly. These are relatively simple tasks that may render otherwise useless resources useful again, for very little capital cost.

They may be used stand alone without the rest of the content of this report.

All work should be trialled first on noncritical or training machines, and undertaken in a careful, neat and non-hurried manner.

The tools involved are no more complex than cleaning materials, a 2 point Phillips head screwdriver, a small flat blade screw driver and a small secure container to hold fasteners while at work, and for storage of small parts.

(for example the machines donated by Computer Bank Australia and the Australian Department of Family and Community Services, would be suitable and were supplied with spare parts and printers for testing and training)

4.1.1 HOWTO Add an IDE Drive

And Increase Your System Capacity

The ability to confidently add an IDE drive to a Personal Computer (PC) is a very useful skill to acquire.

There are many situations where this could be required:

1. The existing Hard Disc Drives show signs of becoming full or unreliable
2. A CDROM player or Burner is required (permanently or temporarily)
3. An extra Hard Disc Drive is required for backing up files
4. The Existing Hard Disc Drive fails and the Operating System (OS) needs to be reinstalled without corrupting the current drive.

There are many other situations, notably the need to install an Operating System when there are not enough CDROM players to go around every machine.

First Some notes:

There are two IDE Outlets on most mother boards (at least) and one FDC (floppy drive Ribbon). The Floppy Drive Control Ribbon has a split and twist at the Floppy drive end and is thinner than the main IDE Ribbons. They are often close together.

Each outlet is identified as IDE 0 / Primary IDE *OR* IDE 1 / Secondary IDE. (sometimes they are “incorrectly” labelled IDE 1 and IDE 2 on the mother board) .

On a standard PC running Windows , Hard Disc Drive C: is the Master Unit on the Primary IDE Ribbon and The CDROM (Hard Disc Drive D:) is the Slave on that same IDE 0 Ribbon. This is just a convention, not a requirement.

Windows RAM discs (and partitioning) aside Drive E: would be the MASTER drive on the Secondary IDE Ribbon and Drive F: would be the SLAVE. The important thing to realise is that each Ribbon may hold up to two drives, and these must be set to be either Master or Slave. You must check the Jumper setting on every drive carefully.

A Step through of the process:

1. Power Down the machine
2. Remove the chassis cover(s) taking care to not misplace the screws.
3. Unplug any peripherals or external Power Connection that may impede this step noting the location of each cable.
4. Having exposed the inner workings of the PC, orientate the Chassis so that you may readily access the [1]Mother Board and all other components. For a tower style machine this usually mean laying it on one side.
5. Check that the Power Lead is plugged into the machine before touching the internal components. If the Power Outlet is of the "[2]ANZAC" style (and is correctly wired) you may safely work on the machine with the power connected but switched OFF at the wall outlet. The idea here is to keep the chassis at earth potential. This helps eliminate damage from static electricity.
6. If the power must stay on please note that *dangerous Voltages are present in the Power Supply section of the Computer.* Beyond the power supply all voltages are Ultra Low Voltage (maximum 15V). None the less care must be taken to avoid dropping screws or other components into a powered up chassis.. You may cause irreparable damage to the circuitry and give yourself a nasty surprise as well. Under NO circumstance attempt to work on the power switch or the Power Supply itself, leave them alone.

---

[1] The large main printed circuit board. It holds all the major parts of the PC.

[2] In this sense a common name for the Australian Style Power Outlets.

7. *Test the chassis for "leakage voltage" (or worse) by using the BACK OF YOUR HAND. Any sensation of tingling or a "rough feel" to the metal indicates that the Machine is not earthed correctly or worse may even be live.. Immediately disconnect the machine at the WALL OUTLET and do not attempt any further work on it. It will need to be repaired by a qualified technician. Remove the machine to a place where it will not be used, until it can be properly and safely repaired. The site electrician should be immediately informed that there may be fault in the buildings wiring. You have a duty of care to yourself and your fellow workers, do not take stupid risks.*

8. Read Point 7 again. Do NOT proceed unless you understand that paragraph.

9. Having got this far you should now make an inspection of ALL connections within the machine. Check all power ([3]Molex) connections are firmly in place, check all Ribbon cables are well bedded into their sockets and all plug-in cards are engaged properly into the respective connectors. Do not remove any drives or cards you do not have to. Once outside the chassis they are vulnerable to static discharge damage.

10. Identify the IDE outlets on the mother board. These will have broad flat Ribbon Cables inserted into them though quite possible only one IDE Ribbon will be fitted. Note that the Ribbons plugged into them have the PIN 1 side marked with a trace of some kind. This is usually as simple as the number 1 wire being a different colour (e.g. Red) or with continuous writing along it. Note the Orientation of this plug.

11. Decide where you want to fit the new drive on the Ribbon, and if permanent where you will mount the drive within the chassis. Will it fit ? Will the Ribbon reach? Is there a Power connector available for it? (you may be able to fit a power splitter if required)

12. Now you MUST check that the Jumper setting on both drives on the selected

---

[3] Translucent Nylon plugs. They have red black and yellow wires connected to them. Widely used in the Automotive and Electronics Industry.

Ribbon are correct. The most probable situation is that the existing drive is set to master (usually the factory default) so set the new drive to slave. CDROM drives usually have this marked clearly on the back near the Jumper pins . Hard Disc Drives are a little more complex but it is often marked on the top of the drive and near the pins where you fit the Jumper itself. (yep they are tiny)

13. OK. Check that again. Then connect the Molex connector (usually curved side up) and then the IDE Ribbon with the pin1 side of the cable closest to the Molex plug. (often it will only go in this way.)

14. Reconnect the mouse , keyboard and monitor (at least). Place the new drive carefully into a secure position, taking great care that it sits flat and that there is no chance of the circuit board making contact with any[4]metal parts. Visually inspect all connections, it is easy to bump them loose. Check for any screws, tools etc. that may be in suspect places.

15. Power the machine up.

16. If all is well , the PC should go through it's normal preboot and [5]Power On Self Tests [POST]. If it fails to do so , beeps repeatedly , or stalls at the Hard Disc Drive tests you have some more work to do. Power off and check orientation of any Ribbons you have altered. They must go *wire one to pin one at both ends*. If the machine does go through POST then you may as well switch it to the BIOS setup screens (try delete key at RAM test or F10 , or F2) . Instructions are normally given as soon as the Extended Memory (RAM) tests are completed.

17. Navigate to IDE setting or Hard Disc Drive Autodetect, follow the instructions and try to get the machine to find and identify your new drive. NOTE: Many (most) machines cannot detect a CDROM drive using this method, try setting the drive type to "AUTO" or CDROM .

18. Don't play with the other settings. If you become confused try loading Optimum settings or Default settings. All IDE drives can be set to AUTO DETECT. Be

---

[4] Most drives work just fine upside down for short periods of time at least.

[5] All PC's must test all internal connections and protocols before the Operating system can be booted up.

aware that the time setting on any UNIX based machine is usually set to GMT (UTC) not local time. Change only what you need to. Engage SMART and UDMA settings for new ATA type Hard Disc Drives.

19. Once you have tested the drive to this point successfully you may as well power down and fit the drive into it's holder permanently (if that is the objective). Test and check again.
20. Power down and reassemble the PC case. Your drive is now ready for use with the Operating system or for formatting etc. Congratulations :)

4.2 HOWTO Install Windows

Using a Temporary CDROM Drive

Any "Standalone" Computer running any Microsoft Operating system really should have a reliable and fast CDROM drive. Any changes to the [6]*OS usually require access to the install CD (or some facsimile of it).*

Unfortunately the CDROM drive is also much abused by the Windows Operating System and often proves to be the least reliable component on a PC. Older units are not uncommon about Social Services and it will occur that Windows will have to be installed or reinstalled where there is either no CDROM drive or the CDROM Drive will refuse to operate correctly.

(Contemporary versions of Windows have the facility to "Network Install")

To fit a new drive either permanently or temporarily please read the preceding Addendum "HOWTO Install an IDE Drive"

Notes:

The following must be in place before you can successfully install Windows 98SE on any machine.

---

[6] *For example: Driver Updates , new Hardware, changes to base applications desktop additions etc.*

Only One IDE drive may have a master boot sector activated. For simplicity this should be the Master IDE Drive on IDE 0 . (Windows calls this HDD C:).

If there is more than one HDD please use FDISK to deactivate extra boot sectors and format each disk (and any partitions) to the default File system.

All Hard Disk Drives will need to have the Large Block Address [LBA] switch enabled. Windows fdisk is quite capable of doing all of this. “Toms Root Boot” or Norton Utilities have even more advanced features. Be prepared to reboot many times to confirm changes.

Where convenient try to install the CDROM drive as the Slave Drive on the first IDE ribbon.

Windows will call this HDD D: (well it is only Windows). Note that during installs the drive addressing (mount points) may well be shifted by the creation of RAM “disks” .. The CDROM will report (While under Windows ONLY) as being one drive up. e.g. drive E: or F: .

The previous paragraph not withstanding consider the following. Under most Operating Systems the IDE buses will run at the slowest speed of any drive accessed during a read/write cycle. Try to group your drives together on the ribbons by speed, modern drives usually have large enough “on disc caches “ to make this less important to the end user.

So before you start a check list:

1. A Windows Systems Floppy (boot) disk (in case the CDROM will not boot) This disk also contains the FDISK program.
2. A Windows Install CD (and the correct registration number)
3. Only the first Hard Disk has the Master Boot Sector Activated. (Install to this drive)
4. All Hard Disc Drives are at least Set to the Windows FAT32 bit file system Type with LBA on. (type c)

5. While a made file system is optional Windows $^{\mathrm{TM}}$ FDISK can do this. The Installer should offer to format the install drive at least for you. (you may format the others from the Interface after the Install is complete.) You can usually remove extra Hard Disc Drives and retrofit/format them later if Windows refuses to install.

6. Optionally a working copy of the "Tom's Root Boot" floppy disk which has tools on board to recover and make Windows Hard Disk Drives. This is a Linux / Minux based disk and uses Unix style (albeit Limited) command line interfaces. Basic instructions are usually available by typing "man fdisk" or "man mkdosfs" .

4.2.1 Step Through to Install

In this section I assume you have *Temporarily fitted a CDROM Drive* to the second (SLAVE) position on the First IDE Ribbon on the PC. Instructions for doing this are in a previous section.

The machine is also assumed to have a single Hard Disk Drive, a working floppy disk drive, a working mouse, keyboard and monitor. (VGA at least).

If you plan to fit a network card, printer, scanner, CDROM Burner or any other "[7]Plug and Play" peripherals now is probably a good time to do so. (You can install the drivers while you have a CDROM Drive attached.)

Leave them unattached until you have completed installing Windows, then install all components before you remove any temporary CDROM drive. (It just keeps the number of leads lying about the place down while you work and speeds up things a little.)

The Steps:

1. Fit the CDROM drive as described in the section "Installing an IDE drive"

---

[7] Also known as Plug and Pray :)

2. Ensure that all IDE Hard Disk Drives are formated to Windows Specification. Specifically this means that only one drive may have it's boot sector activated. The Partition(s) should be typed as FAT32 and have LBA [Large Block Addressing] enabled. If possible format using Windows FDISK or mkdosfs (from Tom's Root Boot).
3. Set the machine to boot from CDROM first . Or have ready to use a Windows Boot Disk. (Systems Disk)
4. Check that the BIOS, POST procedures of the PC are correctly identifying all fitted drives.
5. If all that is done it should just be a matter of Power Cycling the PC with the Windows 98SE (or later) disk in the CDROM drive.
6. Follow the instructions including any formatting requests and select the most modern file system that the installer offers you. When Windows Scandisk offers to repair or resize any files systems say yes.
7. At the end of the install procedure remove the CDROM and any Floppy Discs and boot from the Installed Hard Disk Drive. In Out errors may be simply fixed by running FDISK (from the Windows Systems Floppy) and correctly setting the active boot partitions. Do not proceed until you have checked the system will boot without a CDROM or Floppy in place.
8. If you are removing the CDROM Player reset the BIOS setting to Boot from the Primary Installed Hard Disk Drive Drive Drive. (with the floppy drive as a back up)
9. After you have done this proceed to install any Virus Checkers, peripherals , software suites etc. In that order. Configure them as you go.
10. Finally set up the machine to Automatically de-fragment all Hard Discs, Scandisk, and dump temporary files at least once a week. Run these tools at least once at the end of the install sequence.

Some Hints

Using a Windows System Disc to Run the CDROM

Often through an older BIOS or CDROM player it is not possible to get the PC to boot from the Windows Install disk. It should be possible to set the BIOS to boot from the first floppy drive. (Drive A:)

Place a Windows Systems disk in the floppy drive and Power-Cycle the PC, with the Windows Install CD in the CD Drive. You will soon arrive at a simple menu that offers to boot the machine "With CDROM support." Select that option (usually 2) and wait for the machine to finish loading the appropriate drivers.

Once you have arrived at the Default Command Prompt (A:\) , change directory to the CDROM (try D: or F:). Check you are in the correct place by asking for a directory listing . If so simply type "setup" at the command prompt. All being well you should now be taken through the Windows Install procedure.

As a second hint you can try reloading the Windows Install CD after you arrive at the command prompt. (apparently it will auto-run from DOS .. but not in my experience)

The Commands:

Boot from the Windows System Floppy

Choose	"Start ... WITH CDROM Support"
A:\	D:
D:\	dir /p

(checking for the correct drive)

D:\	setup

4.2.2 USING WINDOWS FDISK

Windows FDISK is a Command Line tool for creating and deleting partitions.

Any alterations to the Hard Disc Partition Tables may render any existing files unreadable. So best to not use it without practice and care.

To use this tool on an uninstalled system you need to boot from a Windows System Disk.

At the DOS Command Prompt enter FDISK.

A “Dialogue” opens that offers you a limited menu of task orientated options.

Entering 4 for example will print out the current status of any Hard Discs that FDISK can see.

5 will change your operations to another Hard Disk Drive.

Take it slowly and read all options carefully. Under DOS (or Windows) you will need to reboot to have the Hard Disk Drives correctly read and write their partitioning information.

FDISK is designed to step you through the logical process of setting up partitions and making a basic file system on your Hard Disk Drives. It does this very well.

For a much more powerful tool try using Tom’s Root Boot and the programs fdisk and mkdosfs it contains.

A brief example is given below.

Note however that the Windows version of FDISK should do most things you will need to install Windows.

One final note. Unless you have a specific requirement it is probably best to create one large partition on each Hard Disk Drive for use under the Windows Operating system.

4.2.3 Using Toms Root Boot

When all else fails

Tom’s Root Boot is an entire Linux like Operating System and tools squeezed onto a single floppy disk.

It is often used to repair broken installs on Windows and Linux (and no doubt other systems).

It uses a Linux style command line interface (without a lot of the nice stuff) but with a little practice can be a powerful rescue tool (and very much more).

To use the disk just power-cycle the machine with the floppy in Drive A.

Each step of the boot sequence has timed out defaults and simple instructions as to how to proceed.

Eventually you will be asked to log in (this is Linux not DOS) follow the instructions and log in as “root”.

The password is by default just 4 X’s. “xxxx” (you will not be able to read them as you enter them)

A fresh screen will open with a silly message of the day at the top .. You are now logged in.

enter “ls” (list) to see the directory structure.

enter “man fdisk” to get some simple instructions on how to use the program fdisk. (man = manual)

For example, if you wanted to work on the first Hard Disk Drive on the first IDE bus you would enter:

“fdisk /dev/hda”

enter “p” at the new prompt to Print out the current partition table.

enter “m” to see a menu of options.

to delete a partition you type “d”

then choose the partition (e.g.) “1”

enter “p” to see that it has or “v” to verify

Making a new VFAT Partition

> *Here are the commands to make a new [8]VFAT partition for windows on the equivalent of hdd C:*

The command prompt is represented by the hash mark #

explanations are enclosed in square brackets [like so]

#fdisk /dev/hda [fdisk work on the device Hard Disk Drive a]

#d [fdisk will ask which partition if there are more than one]

#1 [we choose partition 1]

#p [print the existing proposed partition table (it has not been written yet)] Continue on to delete any other partitions. Then we will make a new primary partition. Don't worry about the other types for now.

#n [tell fdisk you want to make a new partition] (fdisk asks what type and what number)

#p [choose p for primary and 1 for a number] (now fdisk will want to know what size you want. Accept the defaults to get the entire disk. (enter))

#p [print out the new table] By default fdisk makes Linux type partitions we need to change that to a Windows Type. so..

#t [Type]

---

[8] *FAT32*

#1 [Partition One] (#l will give you a list of types .. this can be a little daunting .. just hit enter to escape the list and enter “c”)

#c [a FAT32 system with LBA set on]

#p [see now it’s windows :)] Now one more step before we write the new format, as this is the first drive (/dev/hda = HDD C:)

We need to tell the BIOS (and Windows) to look at this disk as a place to find a boot sector. (for Windows there may only be one of these) So we Activate the disk. Like so:

#a

#1 (if it asks you)

#p [check that the boot flag is set] Now write the new table. This is the ultimate step. Once you press “w” Linux will call low level code to rewrite the partition table, live. (no rebooting here :)

#w [write the new table] Fdisk will then exit. to work on the first Hard Disk Drive on the second IDE ribbon you would call fdisk like this:

#fdisk /dev/hdc (*and for Windows use you would NOT set the boot flag (activate the drive)*) As you can see this is a much more powerful tool than the windows fdisk so keep it simple at first. Linux fdisk has extended features as well that can help you fix and move corrupted partitions. you may feel more comfortable using Norton Utilities disk tools or similar. Or a Linux program call Parted which is brilliant.

We still have one more step to do. We need to make a file system on the new partition so that Windows can “see” it. To do this with Toms Root Boot we use a “simple” little program called “mkdosfs” [make dos file system] just enter the following for now. (there is a space before every “-”)

#mkdosfs -F 32 -n WindowsC -c -v /dev/hda1 This all means: Make a DOS file system with File Allocation Tables of 32 bits (FAT32) name the partition WindowsC (optional), Check the file system for bad blocks, (optional) and tell me about it as you do it (v = verbose). Do all of that on the device "Hard Disk Drive a partition 1".

It should only take a minute or two to finish. If you run with the c switch it will take much longer but will tell your Hard Disk Drive to jump any bad sectors .. use this on second hand or old disks.

You can do much more than this but that will get you by for now. Windows will complain a little but will fix the DOS file system so that it understands it for use on Windows, when you install. (Scandisk)

To exit the Linux system just eject the floppy and type "reboot".

Now boot from the CDROM and Install or follow the instructions to run the "setup " program above.

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Well as we say in the [9]LUG's "Hope this helps"

Peter Gossner

gossner@arcom.com.au

August 2003.

---

[9] Linux User Groups

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